

### Abstract of the Disclosure

A lower electrode 106 with the temperature at its mounting surface set at 40°C is provided inside a processing chamber 104 of an etching apparatus 100. After a wafer W is placed on the lower electrode 106, a processing gas with its gas composition and gas flow rate expressed as  $C_4F_8: CH_2F_2: Ar = 7:4:500$  (sccm) is induced into the processing chamber 104 while sustaining the pressure of the atmosphere inside the processing chamber 104 at 50 (mTorr). High-frequency power at 1500 (W) with the frequency at 13.56 (MHz) is applied to the lower electrode 106 to generate plasma. With the plasma thus generated, a carbon film is formed at shoulder 207 of an  $SiN_x$  film layer 206 exposed inside a contact hole 210 and, at the same time, accumulation of carbon at the bottom of the contact hole 210 is prevented, to form a contact hole 210 achieving a high aspect ratio while preventing damage to the  $SiN_x$  film layer.

## Key

- 100 etching apparatus
- 104 processing chamber
- 106 lower electrode
- 116 temperature control mechanism
- 120 high-frequency source
- 122 upper electrode
- 122a gas outlet hole
- 134, 140, 146 flow-regulating valve
- 136, 142, 148 gas supply source
- 200 Si substrate
- 202 gate
- 204 insulating film layer
- 206 SiN<sub>x</sub> film layer
- 207 shoulder
- 208 SiO<sub>2</sub> film layer
- 210 contact hole
- W wafer